REVIEW ARTICLE

# ULTRASOUND CHARACTERIZATION OF BENIGN BREAST MASSES: A REVIEW

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## ABSTRACT

A lump in the breast in any age group of women leads to the great anxiety. High frequency, high-resolution USG helps in its evaluation. However, it could be difficult to distinguish all benign from all malignant solid breast masses using USG criteria. Short-interval follow-up can be suggested. Ultrasound breast can also identified unsuspected occult masses in mammographicaly heterogeneous parenchyma breast. Various studies in past had discussed differentiating features b/w benign and malignant breast lesion. The American College of Radiology classified the breast masses in BIRADS-US classification. An exploration of literature search was determined utilizing the electronic databases of Pub Med, Google scholar, Elsevier from 200 to 2016 for English-language articles. The search terms utilized were breast masses. The titles and abstract of articles were evaluated Entire text and reviews were appraised when the abstracts meet to the inclusion criterion. This review included all articles that were used for the advancement of information about breast masses.

**KEY WORDS:** Breast ultrasound, Breast mass, ACR BIRADS-US criteria

## INTRODUCTION

Breast masses are common in women from 40% to 70%. Women can detect it herself, on the screening test and by clinician; it may lead to breast cancer in women, irrespective of age[1].Breast malignancy is the fifth most frequent reason of mortality after Lung and GI cancers. In 2012, due to breast cancer521 000 deaths were reported[2]. Majority of breast masses (lump) are benign, but this should not be neglected, need further evaluation of any palpable breast lesion because benign breast disease (BBD) are the major risk factor for breast cancer, they are much more common than malignant lesions, and accurate diagnosis of these lesions are important for optimal care of the patient[3]. Ultrasound has a valuable tool in assessing breast masses. Ultrasonography is a linear array 5-10 MHz or 7-12 MHz[4] used in assessing breast masses.

Mammography sometimes misses small lesions especially in dense breast tissue, which easily detected on Ultrasound. Therefore, ultrasonography is suitable for women having dense breast tissue. In case of suspected lesion, addition to ultrasound with mammography is the best modality[5]. Keeping in mind the popular use of ultrasound, American College of Radiology(ACR) has proposed a BI-RADS lexicon method for breast lesion classification[6,7] which comprises of lesion , its shape, orientation, margin and posterior acoustic transmission, matrix echogenicity and homogeneity, Each lesion was described using these features classified into categories 1to 6 BI-RADS classification for breast ultrasound[8].

**BI-RADS Classification** [9, 10, 11]

BI-RADS 0: In complete study
BI-RADS 1: Negative study, normal breast parenchyma with no solid or cystic lesions or calcification present.
BI-RADS 2: Benign-appearing findings with oval round shape, smooth margins, homogeneous and posterior acoustic shadowing / enhancement.
BI-RADS3: Probably benign short interval follow-up suggest.
BI-RADS 4: Suspicious lesion with ill-defined shape, irregular margin with some speculate, relatively vertical orientation, heterogeneous echotexture and ultrasound guided the core needle biopsy recommended.
BI-RADS 5: Solid lesions with hypoechoic echotexture, polymorphic shape, indistinct, speculated margins with a high suspicion of being malignant, appropriate action should take.
BI-RADS 6: Biopsy proven confirmed malignancy.
BI-RADS7: Classification of breast lesion on ultrasound. (Table 1 and 2) Classification on an analysis and descriptions from several features and categories

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**Table1: BI-RADS US Classification**

| BI-RADS U/S category | Assessment and management |
|---|---|
| 0 | Incomplete additional imaging evolution needed |
| 1 | Negative |
| 2 | Benign |
| 3 | Probably benign short interval follow-up recommended |
| 4 | Suspicious |
| a | Low suspicious |
| b | Intermediate suspicious |
| c | Mederate suspicious |
| 5 | Highly suspicious of malignanacy: biopsy |
| 6 | Biopsy proven confirmed malignancy |

**Table 2: BI-RADS US details**

| u/s descriptor | Features fevering benign | Features fevering malignant | Intermediate features |
|---|---|---|---|
| **Shape of mass** | oval | irregular round | --- |
| **Orientation of mass** | parallel to skin | not parallel to skin | --- |
| **Origin of mass** | circumscribed | Microlobulated, | --- |
| | | Indistinct | --- |
| **Lesion boundary** | abrupt interface | Echogenic halo | isoechoic |
| **Echo pattern** | andchoic, hyperechoic | complex | hypoechoic |
| **posterior acoustic shadowing features** | --- | shadowing, combined pattern | enhancement no posterior |

**Appearance of normal breast parenchyma on ultrasound**

The breast is predominantly composed of adipose and glandular tissues, which appears variable on ultrasound. The appearance of fat on ultrasound is hypoechoic, scattered and tubular hypoechoic structures represent ducts. Cooper's ligaments appear as the thin echogenic band, which become wide as they inserted into an anterior parenchymal surface. An echogenic pseudo mass shadowing denotes the nipple. More fat deposition noticed with advancement of age and parity[12].

**Breast Cyst**

Most common cause of breast lump is a cyst in the underlying parenchyma in premenopausal women, usually causes discomfort, pain, and is slightly tender on palpation. They divided in micro cyst <3 mm, macro cyst>3mmbased on size. Features of a simple cyst on ultrasound are water/fluid containing hypoechoic sacs with well-defined margins without internal acoustic shadows. A cyst with internal echoes with hazy/ dirty appearance and septal formations is termed as a complex cyst. In both cases, a cyst is transonic with posterior echogenic enhancement [12, 13].

**Breast Abscess**

A well-defined mass or a collection of inflammatory tissues in breast is termed as breast abscess. Patients complain of pain tender on palpation, change in color/redness or warmth. These usually occur in Primiparous/breast feeding mothers .Breast abscess is further divided into puerperal abscess (The collection of milk in breast tissue), non-puerperal central abscesses (infectious Variety) commonly seen in non-breastfeeding women, especially smokers and patients who are taking steroids or underwent a recent breast Surgery. Features of a breast abscess on ultrasound comprises of hypoechoic area with a thin echogenic rim that shows posterior acoustic enhancement and it shows no internal vascularity on color Doppler[14, 15].

**Fibrocystic changes in breast**
Fibrocystic changes are termed in many different fashions, namely Mammary dysphasia, cystic mastitis, cystic disease, etc. The demonstration of the above-mentioned condition on ultrasound varies depending on; Morphologic changes, extent and stage. Initially, ultrasound appears normal, with resultant possible echogenic changes and focal parenchymal thickening. Solid masses or Single/-multiple thin-walled cysts also noticed. These lesions may eventually require biopsy[16].

**Ductal Ectasia**
Mammary duct ectasia is a type of non-puerperal benign mastitis .More frequent found in post-menopausal females and characterized by chronic inflammatory and fibrotic changes leading to clogging of debris within the duct. It is of primary importance because of its features mimicking to that of the malignancy. Patient may present with nipple discharge and nipple retraction/tenderness, palpable mass and findings on sonography are dilated, fluid filled subareolar ducts with moving echogenic particulate matter (debris) [17, 18].

**Fibroadenoma**
Excess proliferation of stromal and epithelial cells in breast tissue known as Fibroedenoma with the prevalence in reproductive age between 10 to 40 years[19] presenting as a palpable breast lump on clinical examination. Fibroadenoma enlarges in pregnancy and regress after menopause. They are well-margined macro lobulated mobile lesions with no limitations to its site in the breast tissue appearing hypoechoic with a thin echogenic rim on ultrasonography[20].

**Phyllodes Tumor**
Tumors identical to fibroadenoma with fibro epithelial origin known as Phyllodes Tumor or cystosarcoma. Originating from the periductal stroma, it is solid/cystic(uni or multi), round/cleft-like areas with posterior acoustic shadowing on ultrasonography. Vascularization mostly seen in solid components. Its prevalence is more common in women between 40-60 years of age [4].

**Breast lipoma**
Tumors arising from adipose tissues called lipoma, when present as soft, mobile and painless lesion in breast tissue referred to as Breast Lipoma. They appear as iso/hyperechoic to the prevalent fat with frequent thin echogenic septations running parallel to the skin surface on ultrasound[20].

**Fat necrosis**
It is an inflammatory process secondary mechanical/traumatic insult to the breast tissue resulting in saponification due to fat necrosis. On breast ultrasound, they may appear well-defined hypoechoic areas with +/- mural nodules and subtle wall nodularity in an oil cyst. Ultrasound finding of fat necrosis should be correlated to mammographic findings.[21, 22].

**Complex Sclerosing lesions/ Radial scar** is a benign hyperplastic proliferative disease of breast occurring in women between 40-60 years of age due to local chronic inflammation with resultant slow infarction known as radial scar. These Rosette-Like Lesions which are <1 cm are termed Radial scars, while larger ones are often referred to as Complex Sclerosing lesions.

Radial scars are ill-defined lesion disturbing the architecture of the surrounding breast parenchyma with variable internal echoes and some retro-acoustic attenuation appreciated in ultrasound. These lesions are sometimes rounded, lobulated or oval [22, 23, 24].

**Myofibroblastoma** is an interesting lesion; it would the only one lesion that is more common in men than in women. Patients may presents as a painless, freely mobile, solitary, palpable, firm mass. Sonographicaly it appreciated as a well-structured, circular or oval dense mass approximately size 10mm to 40 mm in diameter [25, 26].

**Pseudoangiomatous stromal hyperplasia (PASH)**
A relatively less common benign mesenchymal over growth within breast tissue occurring in women of the child bearing age and with hormonal in stability are referred to as Pseudoangiomatous stromal hyperplasia or PASH [27].On palpation, these lesions present as well-defined mass in premenopausal women varying in size from 1-12 cm. These lesions appear similar to fibroadenoma on ultrasonography, i.e. hypoechoic and slightly heterogenous[28]. Quite a lot of studies have illustrated the ultrasound features usually found in non-malignant and malignant masses of the breast are as follows

**Breast ultrasound Criteria for benign lesions.**[29, 30]
- Well circumscribed, hyperechoic/ hypoechoic tissue
- Wider than deep
- It is best seen on anterior/posterior margins, perpendicular to the beam
- No vascularity seen on color Doppler ultrasound

**Malignant Characteristics.**[18, 30, 31]
- Sonographic speculation
- Deeper than a wide
- Microlobulations
- Thick hyperechoic halo
- Angular margins
- Branching pattern
- Punctuate calcifications
- Duct extension
- Heterogeneous echotexture
- On increased cellularity demonstrate the vascularity

## CONCLUSION

The primary and cost effective mode of evaluating lesions in breast tissue is ultrasonography. Despite its limitation in distinguishing benign lesion from malignant ones, ultrasonography criteria for the sub group of solid nodules, still offers sufficient information to prevent the patient from multiple and frequent biopsies. It can be helpful in characterization and follow-up, ultrasound breast can also identified unsuspected occult masses in mammographicaly heterogeneous parenchyma breast and can change their pattern of treatment.

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